

the three-dimensional profile of the aspheric shape being cut. Also, the cutting wheel can be adjusted so that its angle relative to a tangent to the glass at point of cut is close to  $90^\circ$  (and not less than about  $70^\circ$ ; not less than about  $80^\circ$  more preferred and not less than about  $85^\circ$  most preferred). In this manner, movement of the cutting support under the cutting wheel, in combination with adjustment of the pitch of the cutting wheel itself, maintains as close to normal (i.e.,  $90^\circ$ ) the cutting angle as possible, and thus achievement of a clean, efficient cut and breakout of the shape. While particularly beneficial for aspheric shapes where the radius can change from about 2000 mm to below 600 mm, and smaller, across the surface of the shape, cutting of convex glass can also benefit from maintenance of a near normal cutting angle for the cutting tool (i.e., cutting wheel).

IN THE CLAIMS:

Prior to examination, please cancel claims 2-27.



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**Brief Description of the Related Technology**

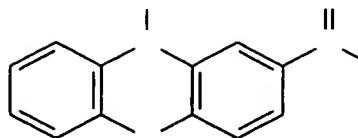
Reversibly variable electrochromic devices are known in the art. In such devices, the intensity of light (e.g., visible, infrared, ultraviolet or other distinct or overlapping electromagnetic radiation) is modulated by passing the light through an electrochromic medium. The electrochromic medium is disposed between two conductive electrodes, at least one of which is typically transparent, which causes the medium to undergo reversible electrochemical reactions when potential differences are applied across the two electrodes. Some examples of these prior art devices are described in United States Patents 3,280,701 (Donnelly); 3,451,741 (Manos); 3,806,229 (Schoot); 4,712,879 (Lynam) ("Lynam I"); 4,902,108 (Byker) ("Byker I"); and I.F. Chang, "Electrochromic and Electrochemichromic Materials and Phenomena", in Nonemissive Electrooptic Displays, 155-96, A.R. Kmetz and F.K. von Willisen, eds., Plenum Press, New York (1976).

Reversibly variable electrochromic media include those wherein the electrochemical reaction takes place in a solid film or occurs entirely in a liquid solution. See e.g., Chang.

Numerous devices using an electrochromic medium, wherein the electrochemical reaction takes place entirely in a solution, are known in the art. Some examples are described in United States Patents 3,453,038 (Kissa); 5,128,799 (Byker) ("Byker II"); Donnelly; Manos; Schoot; Byker I; and commonly assigned United States Patents 5,073,012 (Lynam) ("Lynam II"); 5,115,346 (Lynam) ("Lynam III"); 5,140,455 (Varaprasad) ("Varaprasad I"); 5,142,407 (Varaprasad) ("Varaprasad II"); 5,151,816 (Varaprasad) ("Varaprasad III") and 5,239,405 (Varaprasad) ("Varaprasad IV"); and commonly assigned co-pending United States patent application Serial No. 07/935,784 (filed August 27, 1992) <sup>and now U.S. Patent 5,500,760</sup>. Typically, these

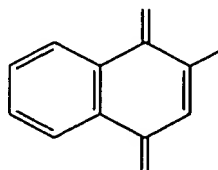
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2-acetyl-phenothiazine  
("APT")  
4-A

An example of a desirable quinone for use as component in the electrochromic monomer composition include, but is not limited to the following structure:



2-hydroxy-naphthoquinone  
5-A

Combinations of components in the electrochromic monomer composition may be selectively chosen to achieve a desired substantially non-spectral selectivity when the electrochromic element (and the mirror in which the electrochromic element is to function) is dimmed to a colored state.

To render anodic electrochromic compounds I and II electrochemically active in the context of the present invention, a redox pre-contacting procedure must be used. Such a redox pre-contacting procedure is described in the context of preparing anodic compounds for electrochemichromic solutions in Varaprasad IV and commonly assigned co-pending United States patent application Serial No. 07/935,784 (filed August 27, 1992), and now U.S. Patent 5,500,760

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trialllyl glucose), polyallyl sucroses (e.g., pentaallyl  
sucrose diacrylate), glucose dimethacrylate,  
pentaerythritol tetraacrylate, sorbitol dimethacrylate,  
diallyl aconitate, divinyl citrasonate, diallyl  
fumarate, allyl methacrylate and polyethylene glycol  
diacrylate.

Ultraviolet radiation absorbing monomers may also be  
advantageously employed herein. Preferred among such  
monomers are 1,3-bis-(4-benzoyl-3-hydroxyphenoxy)-2-  
propylacrylate, 2-hydroxy-4-acryloxyethoxybenzophenone,  
2-hydroxy-4-octoxybenzophenone and 4-methacryloxy-2-  
hydroxybenzophenone, as they perform the dual function  
of acting as a monomer component, or a portion thereof,  
and as an ultraviolet stabilizing agent.

Further, ultraviolet absorbing layers may be coated  
onto, or adhered to, the first substrate and/or second  
substrate, and preferably the substrate closest to the  
source of UV radiation, to assist in shielding the  
electrochromic device from the degradative effect of  
ultraviolet radiation. Suitable ultraviolet absorbing  
layers include those recited in US Patent 5,073,012  
entitled "Anti-scatter, Ultraviolet Protected, Anti-  
misting Electro-optical Assemblies", filed March 20,  
1990, or as disclosed in copending US Patent  
Application 08/547,578 filed October 24, 1995, <sup>now U.S. Patent 5,729,379</sup> the  
disclosures of which are hereby incorporated by  
reference herein.

Examples of such layers include a layer of DuPont  
BE1028D which is a polyvinylbutyral/polyester composite  
available from E.I. DuPont de Nemours and Company,  
Wilmington, Delaware, and SORBALITE™ polymeric UV  
blockers (available from Monsanto Company, St. Louis,  
Missouri) which comprise a clear thin polymer film,  
with UV absorbing chromophores incorporated, such as by

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optionally be combined with inorganic and organic films such as those of metal oxides (e.g., WO<sub>3</sub>, NiO, IrO<sub>2</sub>, etc.) and organic films such a polyaniline. Examples of such films are found in copending US Patent Application 08/429,643 filed April 27, 1995, <sup>now U.S. Patent 5,724,187</sup> and copending US Patent Application 08/547,578 filed October 24, 1995, <sup>now U.S. Patent 5,729,379</sup> and copending US Patent Application 08/330,090 filed October 26, 1994, <sup>now U.S. Patent 5,780,160</sup> the disclosures of which are hereby incorporated by reference herein. Also, the devices of this present invention can benefit from the use of elemental semiconductors layers or stacks, PRM, anti-wetting adaption, synchronous manufacturing, multi-layer transparent conducting stacks incorporating a thin metal layer overcoated with a conducting metal oxide (such as a high reflectivity reflector comprising around 1000 Å of silver metal or aluminum metal, overcoated with about 1500 Å of ITO and with a reflectivity greater than 70%R and a sheet resistance below 5 ohms/square), conducting seals, variable intensity band pass filters, isolation valve vacuum backfilling, cover sheets and on demand displays such as are disclosed in copending US Patent Application 08/429,643 filed April 27, 1995, <sup>now U.S. Patent 5,724,187</sup> the disclosure of which is hereby incorporated by reference herein. Also, as further disclosed in copending US Patent Application 08/429,643 <sup>now U.S. Patent 5,724,187</sup> the solid polymer films of this present invention may comprise within their structure electrochromatically active phthalocyanine-based and/or phthalocyanine-derived moieties including transition metal phthalocyanines such as zirconium phthalocyanine and molybdenum phthalocyanine. Also, the solid polymer films of this invention can be combined with an electron donor (e.g. TiO<sub>2</sub>) - spacer (salicylic acid or phosphoric acid bound to the TiO<sub>2</sub>) - electron acceptor (a viologen bound to the salicylic acid or to the phosphoric acid) heterodyad such as described also in US Patent Application 08/429,643, <sup>(now U.S. Patent 5,724,187)</sup> Such donor-spacer-

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acceptor solid films can function as an electrochromic solid film in combination with the polychromic solid films of the present invention. Further, such as described in US Patent, <sup>5,724,187</sup> ~~Application 08/429,643~~, such chemically modified nanoporous-nanocrystalline films, such as of TiO<sub>2</sub>, with absorbed redox chromophores, can be used in a variety of electrochromic devices and device constructions, including rearview mirrors, glazings, architectural and vehicular glazings, displays, filters, contrast enhancement filters and the like.

Many electrochromic compounds absorb electromagnetic radiation in the about 290 nm to about 400 nm ultraviolet region. Because solar radiation includes an ultraviolet region between about 290 nm to about 400 nm, it is often desirable to shield such electrochromic compounds from ultraviolet radiation in that region. By so doing, the longevity and stability of the electrochromic compounds may be improved. Also, it is desirable that the polychromic solid film itself be stable to electromagnetic radiation, particularly in that region. This may be accomplished by adding to the electrochromic monomer composition an ultraviolet stabilizing agent (and/or a self-screening plasticizer which may act to block or screen such ultraviolet radiation) so as to extend the functional lifetime of the resulting polychromic solid film. Such ultraviolet stabilizing agents (and/or self-screening plasticizers) should be substantially transparent in the visible region and function to absorb ultraviolet radiation, quench degradative free radical reaction formation and prevent degradative oxidative reactions.

As those of ordinary skill in the art will readily appreciate, the preferred ultraviolet stabilizing agents, which are usually employed on a by-weight basis, should be selected so as to be compatible with

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copending US Patent Application 08/429,643 filed April  
27, 1995, <sup>now U.S. Patent 5,724,187</sup> the disclosure of which is hereby  
incorporated by reference herein. Preferably, the  
heater is combined with the mirror reflector mounting  
plate (also known in the automotive mirror art as the  
5 mirror backing plate or the mirror backplate). More  
preferably, the heater and/or the mirror backing plate  
is formed (such as by injection molding, extrusion and  
the like) of a conductive polymer material such as a  
polymer resin incorporating conductive carbon or  
10 conductive metal flakes or fibrils (such as of copper,  
brass, aluminum, steel or equivalent metal). Most  
preferably, the heater and the mirror backing plate are  
formed and attached to the mirror element in an  
integral molding operation as follows. The mirror  
15 reflector glass (that preferably is an electrochromic  
mirror cell but that, optionally, can be a conventional  
mirror reflector such as chromed glass) is placed in a  
mold. A heater (such as a positive temperature  
coefficient heater pad, or a pad formed from a  
20 conductive polymer resin that incorporates metal or  
carbon conducting particles, or a pad formed from a  
resin that is intrinsically self-conducting in its  
resin structure such as a polyaniline resin), is either  
injection molded onto the rearmost glass surface of the  
25 glass reflector element (optionally, with an adhesion  
promoting primer already applied to the rearmost glass  
surface and/or with a heat transfer agent applied to  
the rearmost glass surface), or is attached to the  
rearmost glass surface (or is already pre-attached to  
30 the rearmost glass surface) using a double-sticky tape  
or a hot melt adhesive (preferably, also conducting  
and/or of high heat transfer efficiency such as  
aluminum foil). Finally, a plastic resin is injection  
molded to form the mirror backing plate (and,  
35 optionally, the bezel around the outer perimeter of an  
electrochromic sideview mirror sub-assembly as is

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Also, a cellular phone can be incorporated into the interior mirror assembly with its antenna, optionally, incorporated into the outside sideview mirror assembly or into the inside rearview mirror assembly. Such mounting within the mirror assemblies has several advantages including that of largely hiding the cellular phone and antenna from ready view by a potential thief. Further, a seat occupancy detector coupled to an air bag deployment/disable monitor can be located at, within or on the interior rearview mirror



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In this example, we chose to illustrate the beneficial properties and characteristics of the polychromic solid films manufactured within electrochromic glazings, that may be used as small area transmissive devices, such as optical filters and the like.

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#### A. Preparation of Electrochromic

##### Monomer Composition

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We prepared an electrochromic monomer composition comprising by weight about 2.5% HVBF<sub>4</sub> (as a cathodic compound), about 1.1% MPT having been previously reduced by contacting with zinc [see Varaprasad IV and commonly assigned co-pending United States patent application Serial No. 07/935,784] <sup>now U.S. Patent 5,500,760</sup> (as an anodic compound), both homogeneously dispersed in a combination comprising, in combination as a plasticizer, about 47.7% propylene carbonate and about 1% acetic acid, and about 47.7% "QUICK CURE" B-565 (as a monomer component). We thoroughly mixed this electrochromic monomer composition to ensure that a homogeneous dispersion of the components was achieved.

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#### B. Glazing Assembly With Electrochromic

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##### Monomer Composition

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We assembled electrochromic glazings from HW-ITO coated glass substrates (where the conductive surface of each glass substrate faced one another), with the glass having a sheet resistance of about 15 ohms per square. The dimensions of the glazing assemblies were about 2.5" x 10" x 53  $\mu$ m, with a weather barrier of an epoxy resin coupled with spacers of about 53  $\mu$ m also applied.

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We placed into these glazing assemblies the electrochromic monomer composition of Example 11(A),

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a multi-layer metal reflector coated glass (consisting  
of about 200 angstroms of rhodium undercoated with  
about 1500 angstroms of chromium, and with the chromium  
being disposed between the rhodium layer and the glass  
surface so as to serve as an adhesion promoter layer  
such as is described in US Application No. 08/238,521  
filed May 5, 1994, <sup>now U.S. Patent 5,668,663</sup> the disclosure of which is hereby  
incorporated by reference herein) for the rear  
substrate (where the conductive surface of each glass  
substrate faced one another), with the clear front  
10 glass having a sheet resistance of about 15 ohms per  
square and the rear multi-layered reflector coated  
glass having a sheet resistance of about 5 ohms per  
square. The dimensions of the mirror assemblies were  
about 3.5" x 7.5" x .105  $\mu$ m, with a weather barrier of  
15 an epoxy resin coupled with spacers of about 105  $\mu$ m  
also applied.

We placed into these mirror assemblies the  
electrochromic monomer composition of Example 34 (A),  
20 supra, using the vacuum back filling technique (as  
described in Varaprasad III, supra).

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**C. Transformation of Electrochromic Monomer  
Composition within Mirror to Polychromic  
Solid Film**

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Once the electrochromic monomer composition of Example  
34 (A), supra, was uniformly applied within the mirror  
assemblies of Example 34 (B), supra, we placed the  
assemblies in an electrically heated convection oven  
maintained at about 80°C for about 2 hours whereupon the  
monomer composition reacted to form in situ the solid  
polymer matrix film inside the mirror.

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**D. Use of Electrochromic Mirror**

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33. (New) The variable transmission assembly according to claim 1, wherein at least one of said substrates is constructed from tinted glass.

34. (New) The variable transmission assembly according to claim 1, wherein the spaced-apart distance between said first substrate and said second substrate is from about 10 micron to about 1000 micron.

35. (New) The variable transmission assembly according to claim 34, wherein the spaced-apart distance is from about 20 micron to about 200 micron.

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36. (New) The variable transmission assembly according to claim 35, wherein the spaced-apart distance is from about 37 micron to about 74 micron.

37. (New) The variable transmission assembly according to claims 1, comprising a boundary seal made from a polymeric material.

38. (New) The variable transmission assembly according to claims 37, wherein said polymeric material comprises an epoxy resin, a plasticized polyvinyl butyral, an ionomer resin, a polyamide material, a nitrile containing polymer, or a butyl rubber.

39. (New) The variable transmission assembly according to claims 37, wherein said boundary seal comprises spacers.

40. (New) The variable transmission assembly according to claim 1, wherein said electrochromic monomer composition includes a monomer component selected from the group consisting of acrylated urethanes, acrylated heterocyclics and acrylate resins.